3.3 FIRE ECOLOGY

Laws, Regulations, and Policies

- Protection Act of September 20, 1922 (U.S.C. 594)
- Reciprocal Fire Protection Act of May 27, 1955, as amended (42 U.S.C 1856, 1856a)
- Federal Policy (in addition to citations in Section 1 C)
- Federal Wildland Fire Management Policy & Review 1995
- Review and Update of Federal Wildland Fire Management Policy (USDI-BLM 2001b)
- Smoke permits through Montana/Idaho Airshed; EPA Interim Policy of 1998 for Rx Burning
- Interagency offset and Six Party Fire Protection Agreement between the BLM, Forest Service and Montana DNRC

Affected Environment

Fire Occurrence in the planning area is presented in several sections below, detailing Fire History, Current Fire Policy, Wildland Fire Suppression and Occurrence, Prescribed Burning, Historical Fire Regimes, Fuel Conditions, and Fire Behavior. Fire Risk for the planning area is then discussed.

3.3.1 Occurrence and History

Fire History

Natural fire is a climatic phenomenon. As the natural climate has fluctuated, vegetation communities and fire regimes have changed and wildland fire has expanded and contracted its range. As glaciers receded and forest communities were established, associated changes in weather patterns gave rise to lightning caused wildfires. Native Americans and early settlers also used fire to manipulate the environment. Studies of fire scars and even-aged stands of old timber show a consistent pattern of fire frequency from at least 1600 to1900 (Pyne 1982). However, the devastating fires of 1910 prompted broad-scale fire control and suppression activities that marked the beginning of changes in vegetative communities and fire regimes, which continue today.

Current Fire Policy

Until the 1960's, fire policy emphasized control of all wildfire by 10 a.m. the following day. Prompted by passage of the Wilderness Act of 1964, fire managers began to consider the natural role of fire in the environment. This changed the strategy from fire control to one of fire management. Options available under this new fire management strategy allowed for fire by prescription and a range of suppression alternatives to achieve fire management objectives once initial attack failed. The current Federal Wildland and Prescribed Fire Policy allows fire managers to use the appropriate fire suppression response for all wildfires. These responses vary from aggressive initial attack, with the intent of minimizing the number of acres burned, to monitoring fires in an effort to reduce suppression costs, provide resource benefits, and reduce firefighter exposure to the hazards of fire suppression. The 1984 Fire Management Plan for the Dillon Field Office provides the current direction for fire management activities; however, it has not been updated to reflect current Federal Wildland Fire Policy. The RMP will provide direction to develop a new Fire Management Plan for the planning area.

Wildland Fire Suppression and Occurrence

The Beaverhead-Deerlodge National Forest and the Montana Department of Natural Resources has suppression responsibility for BLM land within the Dillon Field Office. Fire activity records kept between 1982 and 2001 on federal, state, and some private ownerships document 583 fires that burned approximately 28,982 acres. This is about 1% of the area in both Beaverhead and Madison Counties. This does not include the Mussigbrod Fire northwest of Wisdom, Montana that doubled this amount in the year 2000. **Figure 3** displays the fire statistics from 1982 to 2001 (excluding the Mussigbrod Fire).

Prescribed Burning

Since 1982, an average of 125 acres per year of public land in the planning are have been treated by prescribed fire. **Table 31** lists prescribed burning projects completed in the planning area since 1982.

No prescribed burns occurred during the ten year interval between 1989 and 1999 due to prescribed burn escapes and resource concerns. Project planning based upon ecosystem management issues has been completed for a project in the East Grasshopper area. Several more projects are in preliminary stages.

Historical Fire Regimes

Forests and rangelands in the western United States and specifically within the planning area have adapted to fire differently. The fire regime concept is used to characterize the personality of a fire in a given vegetation type–how often it visits the landscape, the type of pattern created, and the ecological effects. **Table 32** displays the natural fire regimes arranged along a temporal gradient, from the most frequent to the least frequent fire return interval (Laverty and Williams 2000).

The majority of the planning area falls within Fire Regimes I and II. The dry forest habitat types and rangelands for the Dillon Field Office fit well within the low to moderate fire regimes. The moist forest types have characteristics similar to the severity of the moderate to high severity fire regimes. For fire planning purposes, habitat types are lumped into three general types: grassland/shrubland, dry forests, and moist forests.

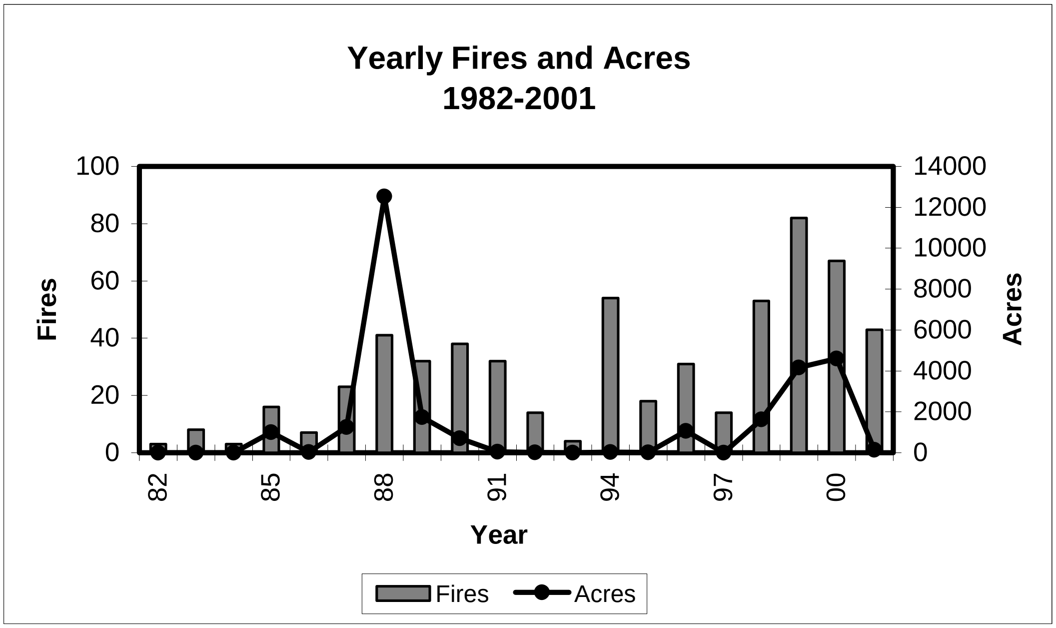
Grassland/Shrubland

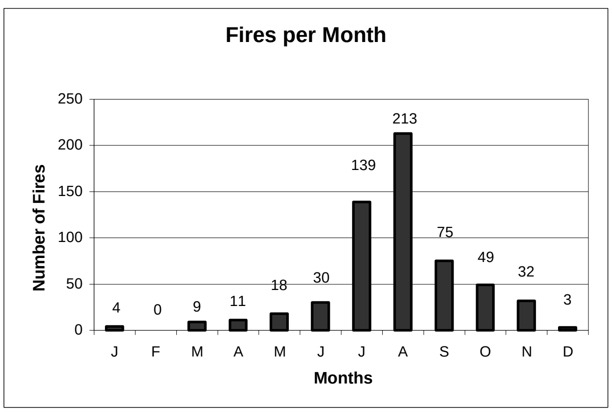
Grassland and shrubland areas are generally dry and fire plays a key role in reducing the conifer encroachment and recycling nutrients back into the soil. Historically, fires generally burned in a mosaic pattern and did not consume all of the vegetation on these sites. Arno and Gruel (1983) estimated a historic mean fire return interval of about 35 to 40 years for southwestern Montana, and Houston (1973) estimated an even shorter period of 20-25 years for similar habitat types in northern Yellowstone Park. In the high valleys of southwestern Montana, big sagebrush is well adapted to these sites, while grasses are poorly adapted to the soils, which have droughty surface conditions. Harniss and Murray (1973) found that 30 years after burning in a sagebrush-grass range, sagebrush yields were about the same on the burned and unburned plots. On sites that received frequent fire, the fuel loading would remain light with an average ½ to 3 tons per acre of available fuel based on the typical grass, shrub fire behavior prediction model (Anderson 1982). Without periodic fires, these areas become encroached by juniper, Douglas-fir, and limber pine.

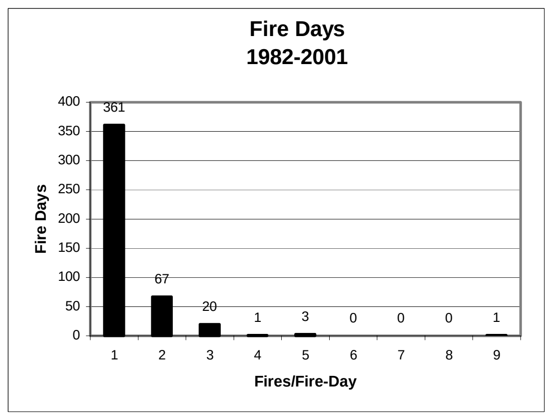
Dry Forests

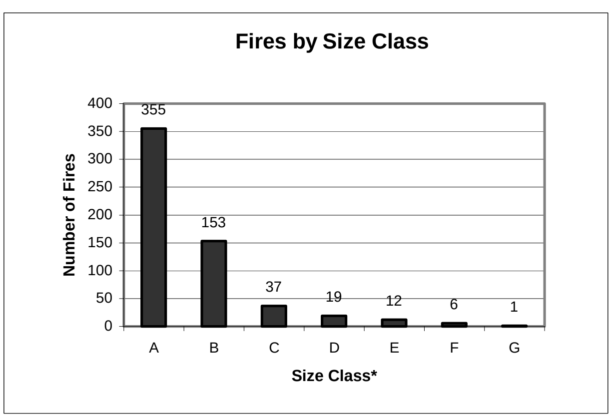
Conifer species that dominate these habitat types are Douglas-fir, limber pine, and juniper. Historically, ground fire maintained many mature stands in an open park-like condition and where dense regeneration occurred, fire played a key role as a thinning agent (Fischer and Clayton 1983). A mean fire return interval of 35-75 years has been estimated in pre-settlement stands in Montana (Arno and Gruel 1983). Fuel loading would usually remain at low levels (<10 tons per acre) and periodic fire would consume needles, dead limbs, and whole trees. In the absence of fire, these forested stands develop

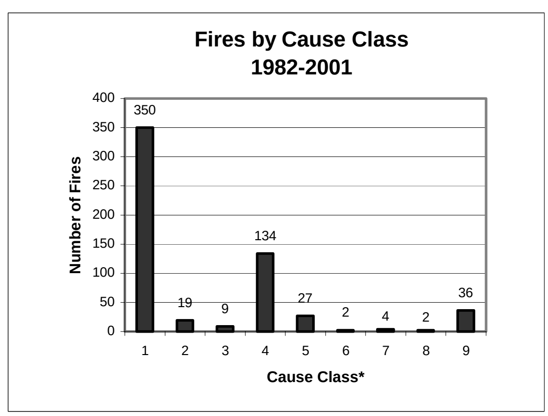
Figure 3. Fire Statistics from 1982 through 2001.











*Size Classes:
A=0-.25 acres, B=.25-10 acres, C=10-99 acres, D=100-299 acres, E=300-999 acres, F=1000-4999 acres, G=5000+ acres

*Cause Classes:
1=lightning, 2-9=human related activities

Table 31. Prescribed Burns Completed in the Dillon Planning Area since 1982

Project Name	Area	Approximate Acres	Approximate Year
Swamp Creek	Big Hole	150	1982
Gravellys	Virginia City Area	150	1983
Timber Gulch	Timber Gulch	400	1984
Centennials	Price Creek Unit 7	40	1985
Centennials	Lima Reservoir	200	1986
McCartney Mtn.	McCartney Mtn.	600	1986
Gravellys	Nevada City	300	1988
Medicine Lodge	Poole Creek	400	2000
	Total Acres	**2240**	

Table 32. Fire Regime Classifications

Regime	Fire Frequency	Fire Effect to dominant above ground vegetation	Representative Ecosystem
Fire Regime I	0-35 years	Low severity	dry pine and juniper forests
Fire Regime II	0-35 years	Stand replacement	grassland/shrubland
Fire Regime III	35-100+ years	Mixed severity	shrubland and mixed conifer forests
Fire Regime IV	35-100+ years	Stand replacement	lodgepole pine and dry Douglas-fir forests
Fire Regime V	200+ years	Stand replacement	high elevation whitebark pine, spruce-fir, and Pacific coastal forests

toward a climax condition with various densities and have several layers in the understory (Fischer and Clayton 1983). With an increase in competition for sunlight, moisture, and nutrients, disease and insect infestations become more prevalent, causing an increase in dead woody fuel loads which in turn cause greater fire severity.

Moist Forests

Conifer species that dominate these wetter or moister habitat types are Douglas-fir, lodgepole pine, spruce, and subalpine fir. The majority of the moist forests fall within the wetter of the Douglas-fir habitat types. Fire is important in these types as a thinning agent and as a stand replacement agent. Historically, low to moderate severity fires converted pole-sized or larger stands to a fairly open condition (Fischer and Clayton 1983). Fire returned to these areas approximately every 40 to 100+ years, dependent upon the habitat type and associated moisture level. Natural fires generally underburned in Douglas-fir stands. Mosaic burn patterns would occur where steep slopes encouraged patches of stand replacing fire. Fuel loading is generally less than 15 tons per acre, but can exceed 15 tons per acre if fire has not entered the area for long periods of time, or where a large stand replacing fire killed the overstory vegetation. Natural fires in lodgepole pine, subalpine fir, and spruce ranged from mixed severity to stand replacing events. These forests have fire return intervals greater than 100 years (Fischer and Clayton 1983).

Fuel Conditions

Fuel conditions are one component of the fire environment used to predict fire behavior and assess potential fire damage to resources. The fire program classifies fuel conditions into four groups based on 13 fire behavior prediction models. These four groups are grass, shrub, timber, and slash. The differences in fire behavior among these groups are related to the fuel load and its distribution among the fuel particle size classes (Anderson 1982).

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Table 33 shows the group distribution in the planning area. The table also includes the number of acres with no vegetation. Some of the acreage displayed in the grass group includes timber types

Table 33. Planning Area Acres by Fuel Condition Group

Group	Approximate Acres within the Planning Area
No Vegetation	8,550
Grass	280,535
Shrub	529,422
Timber	80,399
Slash	0

Fire Behavior

There are three main factors that affect fire behavior: fuels, weather and topography. Each of these factors is variable within a geographical location. Of the three main factors, only fuel conditions can be managed or changed on the ground. The fuel matrix can be changed by wildfire, prescribed fire, grazing, or logging. These changes can affect the rates of spread and intensity of wildland fires. The variability of fuel conditions across the analysis area changes with aspect, slope, and forested structure. Forest structure can be interpreted as three-dimensional patches of fuel, with differing amounts, size classes, arrangements, and flammability. Some fuels, such as large tree boles, rarely are consumed by fire, while others, such as needle litter, are partially to fully consumed in every fire. Other fuels, such as leaves in the tree crowns, are inconsequential in surface fires but are a major source of energy in crown fires. Forest structure affects fire behavior, and fire behavior in turn affects forest structure (Agee 1996).

Grassland/Shrubland

The grass and shrub communities are generally drier, more open places, which have increased wind speeds, higher fuel temperatures, and lower relative humidities. Where these sites were historically free from conifer invasion, there is now a significant increase. The increase of conifers will increase fire intensities and decrease fire suppression effectiveness.

Dry and Moist Forests

A fire moving through a stand of trees may move as a surface fire, an independent crown fire, or as a spectrum of intermediate types of fire. The initiation of crown fire behavior is a function of surface fire intensity and critical parameters of the tree crown layer, its height above the ground, and moisture content. With these physical characteristics currently present, the probability of a crown fire increases in the dry and moist forested stands. Current stands are multi-storied with significant amounts of ladder fuels such as juniper, Douglas-fir, and dead downed fuels in the understory. The current overstory crowns have high crown densities, less spacing, and low height to live crown ratios. These conditions along with steep slopes and extreme weather conditions create the potential for high intensity fires and rapid rates of spread.

3.3.2 Fire Risk

Current conditions are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire suppression, timber harvesting, grazing, introduction, and establishment of exotic plant species, insects or disease (introduced or native), or other past management activities (Laverty and Williams 2000).

Three condition classes were developed to categorize the current condition with respect to each of the five historic Fire Regime Groups. The risk of losing key ecosystem components is highest at Class 3, with little or no risk at the Class 1 level (Laverty, Williams 2000**). Table 34** identifies the approximate acres in the planning area within each Condition Class.

In the planning area, resources that lie near Class 2 and 3 condition class areas are of most concern. Even at current levels of treatment, risks to species, watersheds, forest health, and human communities throughout the interior West are escalating due to increasing fuels buildups (vegetation) in fire-prone environments. As human populations continue to expand and forest fuels accumulate, fire risks will increase. The answer is not in bigger and better firefighting apparatus. At very high fuel loadings, fire behavior overwhelms even the best fire suppression efforts. Under extreme conditions, control of fire becomes dependent on relief in weather or a break in fuels (Laverty and Williams 2000).

Reducing fuels and restoring fire's ecological role in fire-adapted ecosystems can reverse many adverse trends. A change in the horizontal and vertical components of the fuel matrix within rangelands and forests will now carry fire along the surface or through the crowns.

Table 34. Fire Risk Condition Classifications

Condition Class	Description	Approximate Acres Within Planning Area	Example of Typical Management
1	Fire regimes are within a historical range, and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within a historical range. Fires burning in CC1 lands pose little risk to the ecosystem and have positive effects to biodiversity, soil productivity, and hydrologic processes. Class 1 lands are mainly high elevation and moist forest types.	96,388	Historical fire regime is replicated through periodic application of prescribed fire or through fire use.
2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). This results in moderate changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range. Wildland fires burning in CC2 lands can have moderately negative impacts to species composition, soil conditions, and hydrological processes. All of the grass and shrub habitat types in the planning area are included in Condition Class 2.	764,665	Moderate levels of restoration treatments are required, such as a combination of prescribed fire with mechanical/hand treatment.
3	Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range. Wildland fires burning in CC3 lands may eliminate desired ecosystem components, exacerbate the spread of unwanted non-native species, and result in dramatically different ecological effects compared to reference conditions. Condition Class 3 areas in the planning area are mainly located in the dry forest and woodland habitat types.	27,765	High levels of restoration treatments, such as mechanical treatments, are required before fire can be used to restore desired ecosystem function. Intensive efforts, which may include seeding, herbicide application, biomass removal, and other types of rehabilitation, are required for CC3 lands.